REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1, 4 and 33-41 are pending, with Claims 1, 4, and 33-37 amended by the present amendment.

In the Official Action, Claim 35, and all claims depending therefrom, were rejoined to the previously examined claims; Claim 36 was rejected under 35 U.S.C. §112, second paragraph; Claims 1, 33, 35 and 37-41 were rejected under 35 U.S.C. §102(b) as being anticipated by Garrish et al. (U.S. Patent Publication No. 2001/0040720, hereinafter "Garrish"); and Claims 4, 34 and 36 were rejected under 35 U.S.C. §103(a) as being unpatentable over Garrish in view of Ye (U.S. Patent No. 6,414,788).

Claims 1, 4, and 33-37 are amended to more correct the formatting errors identified in the Official Action, and to more clearly describe and distinctly claim Applicants' invention. Support for these amendments is found in Applicants' originally filed specification. No new matter is added.

Briefly recapitulating, Claim 1 is directed to an optical amplifying method of an optical amplifier connected to an optical transmission line. The method includes detecting an optical input and output power of the optical amplifier; obtaining a difference between a target gain and a measured gain of the optical amplifier obtained based on the detected optical input and output power to produce an error signal; applying the error signal to each of a proportional calculation and an integral calculation to create respective proportional and integral control signals, and adding proportional and integral control signals to create a drive current of at least one pump laser diode provided in the optical amplifier; controlling the gain of the optical amplifier with the drive current; and adjusting a control parameter of the proportional calculator in response to the detected optical input power. *The control*

parameter is a proportional constant by which the error signal is multiplied to form the proportional control signal. The proportional constant is represented by a function of the optical input power as a result of the adjusting the control parameter in response to the detected optical input power.

Claims 33 and 35 are directed to optical amplifiers each reciting a proportional constant control parameter by which an error signal is multiplied, where the proportional constant control parameter is represented by a function of the optical input power.

Garrish describes an optical amplifier that uses a proportional plus integral (PI) controller where u(t) represents current or power that controls a laser pump; K_p is a proportional constant of the PI controller; K_i is an integral constant of the PI controller; E(t) represents an error signal (i.e., the difference between a desired value for a gain or output power given a set point).[1]

The Official Action incorrectly asserts that Gerrish discloses means for adjusting a control parameter (u(t)) of the proportional calculator in response to the detected optical input power (Pin). U(t) is a control output from the PI controller, not a proportional constant (K_p) of the pr portion calculator or the P controller. According to the present invention, it is the proportional constant that is adjusted (controlled) in response to the input power, where the proportional constant is represented as a function of the input power as a result of adjusting the proportional constant in response to the input optical power to the optical amplifier. In contrast, in Gerrish the control output u(t) from the PI controller is fed to drive the pump laser diode W_{LP}.

A difference between Gerrish and Applicants' invention is that Gerrish uses a *fixed* proportional constant (by which the error signal is multiplied to form the proportional control signal). This fixed proportional constant is not changed irrespective of the magnitude of the

---

[1] Garrish, paragraphs [0021]-[0026].

input optical power to the optical amplifier. In contrast, in Claims 1, 33 and 35, a *variable* proportional constant is controlled or adjusted in response to the detected input optical power by an adjusting means (e.g., gain adjusting circuit 19f in FIG. 6) so that the proportional constant is represented by a function of the input optical power. This means that Applicants' claimed proportional constant *varies* depending on the magnitude of the input optical power to the optical amplifier.

This difference is non-trivial because using Applicants' proportional constant adjusting means (or using a variable proportional constant as a function of the input optical power as recited in Claims 1, 33 and 35) significantly improves the performance of the optical amplifier apparatus in terms of operation stability and transient behavior.

Although the optical amplifier apparatus configured as described by <u>Gerrish</u> may be miniaturized, the apparatus of <u>Gerrish</u> is suboptimal. FIG. 4 of <u>Gerrish</u> shows a curve called "threshold for oscillation," where a region below the curve corresponds to where optical amplifier operations are stable, while a region above the curve corresponds to where the optical amplifier is unstable (i.e., the amplifier output can oscillate).

Also shown in FIG. 4 of <u>Gerrish</u> is a curve called "gain required to obtain appropriate transient characteristics," where a region below this curve defines where a transient response of the optical amplifier is unsatisfactory (e.g., the optical amplifier output undergoes a large temporary change before the output is settled when responding to a sudden change in the amplifier input power (e.g., step change as seen in FIG. 15)). The region above the curve defines where the transient response of the optical amplifier is satisfactory. That is, the optical amplifier has a reduced transient behavior in the region above the curve "gain required to obtain appropriate transient characteristics."

In FIG. 4 of <u>Gerrish</u>, a fixed horizontal dotted line "SET GAIN" indicates the use of a fixed proportional constant, which is denoted by k0. In the optical input power vs. gain

graph of FIG. 4, the proportional constant given by the line "SET GAIN" corresponds to where the optical amplifier operates. It can readily be seen from FIG. 4, that the optical amplifier operations are unstable when the input power is low ("optical input range of oscillation" in FIG. 4.)

Further, it can readily be seen from FIG. 4 of <u>Gerrish</u>, that the optical amplifier has an unsatisfactory (i.e., large) transient response when the input optical power is high ("optical input range of inappropriate transient response" in FIG. 4.) This presence of large transient behavior that is inherent in <u>Gerrish</u> is one problem that the present Applicants have cured with the invention recited in pending Claims 1, 33 and 35. With Applicants' claimed invention, the above problem can be solved or alleviated by using a proportional constant that varies as a function of the input optical power. This is achieved by controlling or adjusting the proportional constant of the proportional calculation in response to the detected optical input power, as recited in Claims 1, 33 and 35.

Non-limiting examples of the optical amplifier operation using such a variable proportional constant as a function of the input optical power are illustrated in Applicants' FIG. 8 and FIG. 11. As seen in the optical input power vs. gain plane of Applicants' FIG. 8, the optical amplifier apparatus operates within a region between the curves "threshold for oscillation" and "gain required to obtain appropriate transient characteristics or response," irrespective of the magnitude of the input optical power to the amplifier. This is because the proportional constant *varies* as a function of the input optical power. In FIG. 8, the proportional constant is denoted by k which is given by $A \cdot P_{in} + B$, where P_{in} represents the optical input power, and A and B each represent a constant (i.e., fixed value). Similarly in Applicants' FIG. 11, the proportional constant is *adjusted in response to the input power to the optical amplifier* so that the proportional constant k in FIG. 11 *changes* (here, stepwise) depending on the magnitude of the input power.

Gerrish does not acknowledge the problems detailed above, let alone provide the solution recited in Claims 1, 33 and 35 (i.e., adjusting the proportional constant in the proportional calculation in response to the detected optical input power to the optical amplifier apparatus so that the proportional constant is represented as a function of the input optical power).

MPEP § 2131 notes that "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). See also MPEP § 2131.02. "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Because Gerrish does not disclose or suggest all the features recited in Claims 1, 33 and 35, Gerrish does not anticipate the invention recited in Claims 1, 33 and 35, and all claims depending therefrom.

Applicants have considered Ye and submit Ye does not cure the deficiencies of Gerrish. As none of the cited prior art, individually or in combination, disclose or suggest all the elements of independent Claims 1, 33 and 35, Applicants submit the inventions defined by Claims 1, 33 and 35, and all claims depending therefrom, are not rendered obvious by the asserted references for at least the reasons stated above.[2]

---

[2] MPEP § 2142 "...the prior art reference (or references when combined) must teach or suggest **all** the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)."

Accordingly, in view of the present amendment and in light of the previous

discussion, Applicants respectfully submit that the present application is in condition for

allowance and respectfully request an early and favorable action to that effect.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

R. Fitea Reg. No 59,140

Bradley D. Lytle
Attorney of Record
Registration No. 40,073

Michael E. Monaco
Registration No. 52,041

Customer Number

22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 03/06)
MM/rac

I:\ATTY\MM\257706US-AM2.DOC